Exhibit W

Data-Over-Cable Service Interface Specifications DOCSIS® 3.1

Physical Layer Specification

CM-SP-PHYv3.1-I04-141218

ISSUED

1 SCOPE

1.1 Introduction and Purpose[1]

This specification is part of the DOCSIS® family of specifications developed by Cable Television Laboratories (CableLabs). In particular, this specification is part of a series of specifications that defines the fifth generation of high-speed data-over-cable systems, commonly referred to as the DOCSIS 3.1 specifications. This specification was developed for the benefit of the cable industry, and includes contributions by operators and vendors from North and South America, Europe and Asia.

This generation of the DOCSIS specifications builds upon the previous generations of DOCSIS specifications (commonly referred to as the DOCSIS 3.0 and earlier specifications), leveraging the existing Media Access Control (MAC) and Physical (PHY) layers, but with the addition of a new PHY layer designed to improve spectral efficiency and provide better scaling for larger bandwidths (and appropriate updates to the MAC and management layers to support the new PHY layer). It includes backward compatibility for the existing PHY layers in order to enable a seamless migration to the new technology.

There are differences in the cable spectrum planning practices adopted for different networks in the world. For the new PHY layer defined in this specification, there is flexibility to deploy the technology in any spectrum plan; therefore, no special accommodation for different regions of the world is required for this new PHY layer.

However, due to the inclusion of the DOCSIS 3.0 PHY layers for backward compatibility purposes, there is still a need for different region-specific physical layer technologies. Therefore, three options for physical layer technologies are included in this specification, which have equal priority and are not required to be interoperable. One technology option is based on the downstream channel identification plan that is deployed in North America using 6 MHz spacing. The second technology option is based on the corresponding European multi-program television distribution. The third technology option is based on the corresponding Chinese multi-program television distribution. All three options have the same status, notwithstanding that the document structure does not reflect this equal priority. The first of these options is defined in Sections 5 and 6, whereas the second is defined by replacing the content of those sections with the content of Annex C. The third is defined by replacing the content of those sections with the content of Annex D. Correspondingly, [ITU-T J.83-B] and [CEA-542] apply only to the first option, and [EN 300 429] apply to the second and third. Compliance with this document requires compliance with one of these implementations, but not with all three. It is not required that equipment built to one option shall interoperate with equipment built to the other.

Compliance with frequency planning and EMC requirements is not covered by this specification and remains the operators' responsibility. In this respect, [FCC15] and [FCC76] are relevant to the USA; [CAN/CSA CISPR 22-10] and [ICES 003 Class A] to Canada; [EG 201 212], [EN 50083-1], [EN 50083-2], [EN 50083-7], [EN 61000-6-1], and [EN 61000-6-3] are relevant to the European Union; [GB 8898-2011] and [GB/T 11318.1-1996] are relevant to China.

1.2 Background

1.2.1 Broadband Access Network

A coaxial-based broadband access network is assumed. This may take the form of either an all-coax or hybrid-fiber/coax (HFC) network. The generic term "cable network" is used here to cover all cases.

A cable network uses a tree-and-branch architecture with analog transmission. The key functional characteristics assumed in this document are the following:

- Two-way transmission.
- A maximum optical/electrical spacing between the CMTS and the most distant CM of 50 miles (80 km) in each direction, although typical maximum separation may be 15 miles (24 km).

[1] Revised per PHYv3.1-N-14.1202-3 on 12/11/14 by JB.

Burst	A single continuous RF signal from the cable modem upstream transmitter, from transmitter on to transmitter off.
Burst Noise	1) Another name for impulse noise. 2) A type of noise comprising random and sudden step-like changes between levels, often occurring in semiconductors. Sometimes called popcorn noise.
Cable Modem (CM)	A modulator-demodulator at the subscriber premises intended for use in conveying data communications on a cable television system.
Cable Modem Termination System (CMTS)	A device located at the cable television system headend or distribution hub, which provides complementary functionality to the cable modems to enable data connectivity to a wide-area network.
Carrier-To-Noise Ratio (CNR or C/N)	1) The ratio of signal (or carrier) power to noise power in a defined measurement bandwidth. 2) For OFDM and OFDMA signals, the ratio of average signal power (P_{SIGNAL}) in the occupied bandwidth to the average noise power in the occupied bandwidth given by the noise power spectral density integrated over the same occupied bandwidth, expressed mathematically as $CNR = 10\ log_{10}[P_{SIGNAL}/\int N(f)df]$ dB. Note: This is a lower bound on the actual received signal-to-noise ratio. 3) For SC-QAM, the ratio of the average signal power (P_{SIGNAL}) to the average noise power in the QAM signal's symbol rate bandwidth (N_{SYM}), and expressed mathematically as CNR = 10 $\log_{10}(P_{SIGNAL}/N_{SYM})$ dB or equivalently for an AWGN channel as CNR = 10 $\log_{10}(E_S/N_0)$ dB. Note: For an AWGN channel, $P_{SIGNAL}/N_{SYM} = (E_S/T_S)/(N_0\, B_N) = (E_S/T_S)/(N_0/T_S) = E_S/N_0$, where E_S and T_S are the symbol energy and duration respectively, N_0 is the noise power spectral density, and B_N is the noise bandwidth equal to the symbol rate bandwidth $1/T_S$. 4) For analog television signals, the ratio of visual carrier peak envelope power during the transmission of synchronizing pulses (P_{PEP}) to noise power (N), where the visual carrier power measurement bandwidth is nominally 300 kHz and the noise power measurement bandwidth is 4 MHz for NTSC signals. For the latter, the noise measurement bandwidth captures the total noise power present over a 4 MHz band centered within the television channel, and is expressed mathematically as CNR = 10 $\log_{10}(P_{PEP}/N)$ dB. Note: For analog PAL and SECAM channels, the noise measurement bandwidth is a larger value than the 4 MHz specified for NTSC (4.75 MHz, 5.00 MHz, 5.08 MHz, or 5.75 MHz, depending on the specific system).
CEA-542	A Consumer Electronics Association standard that defines a channel identification plan for 6 MHz-wide channel frequency allocations in cable systems.
Ceiling (Ceil)	A mathematical function that returns the lowest-valued integer that is greater than or equal to a given value.
Channel	A portion of the electromagnetic spectrum used to convey one or more RF signals between a transmitter and receiver. May be specified by parameters such as center frequency, bandwidth, or CEA channel number.
Codeword	Forward error correction data block, comprising a combination of information bytes and parity bytes.
Codeword Error Ratio (CER)	The ratio of errored codewords to the total number of codewords transmitted, received, or processed over a defined amount of time. Mathematically, CER = (number of errored codewords)/(total number of codewords). Usually expressed in scientific notation format.
Coefficient	Complex number that establishes the gain of each tap in an adaptive equalizer or adaptive pre-equalizer.